

Dean, School of Engineering

Globally acknowledged as the foremost in its field, MIT's School of Engineering has a four-part mission: to lead the profession by setting new directions through innovative models for education and research, to create new engineering knowledge and technologies, to transform and impact society through engineering practice and research, and to produce and train the next generation of pioneers in engineering education, research, and industry. To advance this mission, the MIT School of Engineering has a vision and a set of strategies for its implementation that forward all of these components as a single, unified, interconnected objective.

The faculty, students, and staff in the School of Engineering perform cutting-edge research that advances scientific frontiers and solves major and complex technological problems. They also train future innovators and leaders in engineering, science, and technology who will transform society. We continue to compete successfully against a growing number of institutions that aspire to MIT's leadership in science, technology, and engineering.

Currently, the School's eight departments and one division encompass a community of some of the world's brightest and most inventive thinkers—about 37% of the Institute's faculty, more than 45% of MIT graduate students, and about 43% of MIT's undergraduate majors, collaborating in over 40 undergraduate degree programs, 71 graduate programs, and a faculty research base of nearly \$244 million in FY2008. The achievements of the School's departments, laboratories, centers, and programs are extensive. Separate reports submitted by these units highlight their activities and accomplishments over the past year.

As a result of this year's faculty searches, 16 exceptional candidates have accepted faculty appointments as assistant professors in the School of Engineering. Their appointments will infuse nearly every department in the School with the excellence, excitement, and energy critical to maintaining the very high standards we have always set for ourselves. There were also a number of important leadership transitions within the School's faculty. Ian Waitz, the Jerome C. Hunsaker professor of aeronautics and astronautics, was named head of his department; his predecessor, Wesley L. Harris, moved to the position of associate provost for faculty equity. Mary Boyce, the Gail E. Kendall professor of mechanical engineering, was also named head of her department; her predecessor, Rohan Abeyaratne, the Quentin Berg professor of mechanics, was named codirector of the Singapore–MIT Alliance for Research and Technology Center. In addition, Barbara Liskov, Ford professor of engineering and associate provost for faculty equity, was named an Institute Professor, and Alan Willsky was named interim director of the Laboratory for Information and Decision Systems.

Now at the end of his first full year, the dean of the School of Engineering conducted a yearlong strategic planning exercise that integrated input from the Engineering Council (comprising the dean, the associate deans, and the engineering department and division heads) and the directors of School of Engineering research centers and laboratories

as well as a faculty-driven Strategic Planning Council that sought broad input and suggestions on key issues from within and outside MIT.

Engineering Vision

The School of Engineering's position of leadership requires resources of all types—intellectual, physical, and financial—and in today's competitive academic landscape, a deficit in any one of these categories can quickly lead to a decline in the others. We are also entering a phase in which the most effective and useful commitments and activities are those that touch the broadest range of fields, researchers, and disciplines.

The intellectual core of current major thrusts in engineering and engineering science resides in such interdisciplinary areas of inquiry as information and communication engineering; biological and biomedical engineering; materials and device engineering; and engineering science for mechanical, physical, and space structures and infrastructure. Computational engineering and integrated engineering of macro systems are intellectual disciplines that span all of these thrust areas. In this landscape it is crucial to create systems, spaces, and opportunities that nucleate and broaden interdisciplinary activities while simultaneously solidifying and enhancing deep disciplinary programs and activities.

The School of Engineering is also a key driver in the Institute's initiatives on energy, the intersection of life sciences and engineering, and internationalization. Faculty from all of the School's departments are actively directing, participating in, and shaping each of these initiatives.

Enhancing Engineering Education

The School of Engineering has embarked on a set of initiatives to provide greater exposure to engineering for all MIT undergraduates through the proposed changes to the General Institute Requirements (GIRs). Efforts are also under way to provide more hands-on experience, project- and context-based learning, and leadership training through the newly instituted Bernard M. Gordon-MIT Program for Engineering Leadership. In addition, possibilities for rigorous broad-based undergraduate training in engineering for students seeking careers in engineering, science, research, management, or medicine and an engineering minor for those focusing on other disciplines at MIT are under discussion. Creating more opportunities for international engagement for undergraduate students through the Undergraduate Research Opportunities Program (UROP) and the Undergraduate Practice Opportunities Program (UPOP) is another goal for the next several years.

Education Innovation and Assessment

During the 2007–2008 academic year, the Office of Education Innovation and Assessment (EIA) in the School of Engineering successfully managed the Accreditation Board for Engineering and Technology (ABET) reporting process for 14 undergraduate programs. Success was based on a School-wide continuous improvement process developed by EIA that occurs in the six years leading up to the accreditation year. That process includes a centralized scheme for School-wide engineering-specific senior, alumni,

and employer surveys; a web-based longitudinal database of learning outcomes; and web-based tools for program and subject assessment. EIA also supports departments in their use of program and subject assessment data for annual continuous improvements in undergraduate curricula and subjects during the six years between ABET visits, a necessary activity as part of ABET Engineering Criteria 2000 (EC 2000).

EIA also developed a teaching assistant (TA) workshop that is given twice per year to all new TAs in the School. Over 100 TAs attended the workshops. Along with the TA workshop, a TA website was developed that provides teaching tools and tips and links to key engineering education literature. EIA supported the dean's strategic planning process and provided key data on peer school competitive position as well as a policy distillation of key engineering senior and alumni data. EIA completed a full assessment of the freshman GIR project-based learning subjects. EIA's analysis has led to an accepted paper at the 2009 American Society for Engineering Education (ASEE) Annual Conference.

EIA continued its participation in key external engineering education groups, including the ASEE associate dean's engineering education group, and in the National Academy of Engineering's Center for the Advancement of Scholarship on Engineering Education. EIA completed a full assessment of the School of Engineering's Science Technology Engineering and Math (STEM) Program; the assessment showed the program's success and, in part, led to the program's continued funding by the Hayden Foundation. EIA continues to support assessment of UPOP and has shown its very positive impact on development of students' professional abilities.

Undergraduate Practice Opportunities Program

The School of Engineering's Undergraduate Practice Opportunities Program is a full-year cocurricular program that helps MIT sophomores gain the knowledge, skills, and attitudes they need to effectively apply classroom learning to successful careers in engineering leadership. The program is delivered in five phases, including seminars and individual coaching during fall and spring semesters, a five-day intensive professional development workshop during January Independent Activities Period, a summer internship of hands-on engineering practice, and a final reflective program in the fall of the junior year. Curriculum topics include team decision making, conflict resolution, negotiation, robust engineering, specification design, agile engineering, persuasive presentations, and professional etiquette and networking. UPOP's seventh year began in the fall of 2007 when 264 members of the class of 2010 registered for the program. Of those, 207 were enrolled in the program and completed the course requirements culminating in a summer internship. Nearly 100% of our employers report that they would rehire their UPOP intern, and many employers register to hire UPOP interns year after year.

Development and Communications

The dean has made engagement with the School of Engineering's alumni community a priority. Effective, timely, and compelling communications about MIT, the School, and about engineering in general are crucial to these efforts and to the continued success of the School. As a leadership institution, MIT must embrace and even attempt to exceed

the justifiably high expectations for its development and communication efforts. To this end, revitalizing the School's efforts in this area was a priority for the 2007–2008 year. Despite some transitions in staffing, significant advances were achieved.

Beginning with a new logo, which was completed in the late spring, the School's overall graphic identity and public appearance is in the process of being updated and transformed. The cornerstone of this transformation will be the School's website, scheduled to launch at the beginning of classes in fall 2008. A great many other communication projects were initiated in 2007–2008, and they will continue. We anticipate having much to report in this area next year.

Another notable communications achievement for the School was the successful launch of MIT TechTV, a website for sharing online video within the MIT community. Since its inception, MIT TechTV has been an unqualified success: nearly two *million* videos have been viewed on the site, it has contributors and participants from all five schools at MIT (as well as the MIT Museum, the News Office, the Admissions Office, the Libraries, etc.), and it has been featured in major market news publications as an example of “how current MIT students and faculty communicate with each other.”

Engineering Outreach

The Office of Engineering Outreach Programs (OEOP) in the School of Engineering runs academic enrichment programs for middle and high school students. These programs are all offered free of charge and focus on exposing students to engaging and challenging curricula in engineering and science. Our goal is to provide traditionally underserved students with multiple entry points to academic and professional careers in the science, technology, engineering, and mathematics (STEM) disciplines.

OEOP's core programs—the Minority Introduction to Engineering and Science (MITES) Program, the Saturday Engineering Enrichment and Discovery (SEED) Academy, the STEM Program, and the MIT Science of Baseball Program (MSBP)—also support MIT's mission to sponsor K–12 programs that foster unique learning experiences for students and help build a pipeline of diverse and highly qualified scientists and engineers. MIT, through OEOP, is committed to increasing the number of underserved and underrepresented students at top institutions in the nation and around the world.

In the summer of 2008, we initiated the SEED Confronting Obstacles and Realizing Excellence (CORE) Program for local high school students. The SEED CORE Program provided students who struggle with math skills with a curriculum focused on increasing their quantitative reasoning skills.

OEOP makes significant efforts regarding the maintenance of its financial resources and support. In close cooperation with the dean of engineering and MIT resource development officers, OEOP has secured funding for its programs from a broad range of corporations, foundations, agencies, and other groups, as well as its own alumni, MIT alumni, and the parents of former program participants.

Short reports about each of OEOP's constituent programs are presented below. The following are some of our most notable achievements and highlights from the 2007–2008 year: 78% of 2007 MITES participants were accepted to MIT, and 64% are attending as members of the class of 2012.

- 100% of this year's SEED Academy seniors were accepted to college, and 80% of them intend to major in technical fields.
- 91% of MSBP participants believe they learned about interesting concepts in math and science during the program and that science and math are important to baseball.
- Last summer, 21 ninth graders—76% of whom were returning students—participated in the STEM Program.

Minority Introduction to Engineering and Science Program

Since its inception 33 years ago, 1,765 students have participated in the MITES Program—34% (over 600 students) of whom went on to matriculate at MIT. MITES students who attend MIT are also consistently strong performers, performing well within their cohorts and graduating at a rate 12 percentage points higher than that of other minority students at the Institute.

Last summer, the MITES Program selected 66 high school seniors to participate in its rigorous six-week summer session. The selected students come from 24 states and Puerto Rico. MITES participants took courses in calculus, physics, and chemistry, biology, or biochemistry; a writing-intensive humanities course; and a project-based course (genomics at the Broad Institute, digital design, engineering design, or electronics). The program receives significant support from private corporations and foundations, MIT alumni, and parents of former participants. Of the students who attended MITES in 2007, 41 (or 64%) are attending MIT as members of the class of 2012.

Saturday Engineering Enrichment and Discovery Academy

The SEED Academy, an academic enrichment and technical career exploration program for Boston, Cambridge, and Lawrence public high school students, is in its seventh year. The seven-semester program is designed to strengthen participants' fundamental mathematics, science, and communication skills using an original, hands-on curriculum. To date, the program has served almost 200 students. In 2007–2008, the program graduated its fourth class of students, 100 percent of whom were accepted into college and 80 percent of whom plan to major in technical fields.

Science Technology Engineering and Math Program

Now in its fifth year, the STEM Program is a nonresidential, year-round academic enrichment and mentoring program for local public school students in grades 6 through 9. STEM consists of three components: a five-week summer academic phase on the MIT campus to prepare students for "gateway" high school math and science courses, an academic-year mentoring program that pairs each STEM student with an MIT student, and workshops to empower STEM parents to advocate for and equip their children for

academic success. Last year, 84 students from Boston and Cambridge public schools completed the 2008 summer academic phase, and 56 (or 67%) elected to participate in the academic-year mentoring program.

MIT Science of Baseball Program

A four-week summer enrichment program, MSBP has just completed its second summer of operation. The students in the program are eighth-grade boys from Boston and Cambridge public schools. The program is geared toward underserved youth who are not achieving high marks in math and science, but are interested in baseball and might benefit from a program combining math and science lessons with baseball skills. MSBP integrates an experiential curriculum with academic topics. Throughout the program, students work on their baseball skills as they develop an understanding of the mathematics, science, and culture behind the sport and synthesize all of these elements into the strategy of the game through the study of statistics and probability.

Innovation, Invention, and Entrepreneurship

Innovation, invention, and entrepreneurship are hallmarks of MIT in general and the School of Engineering in particular. The School's emphasis on encouraging technological innovation and invention, among faculty and students alike, took some new forms this year as it continued to build on its strengths.

In 2007, the School of Engineering launched the International Innovation Initiative (I³, or "I-cubed"). The program will strengthen, connect, and accelerate MIT's innovation efforts around the globe. I³ creates opportunities for the MIT education and research community to come together with international partners to stimulate innovative approaches to present and future global problems, and move these technologies from the laboratory to the global marketplace. The search for an executive director for I³ is under way, and we expect to make a more significant report of its accomplishments next year.

Among the School's other programs in support of innovation and invention among MIT faculty and students are the Deshpande Center for Technological Innovation and the Lemelson-MIT Program (each of which has submitted its own Report to the President), as well as the MIT \$100K competition.

Personnel

A significant number of new staff and deans joined the School of Engineering in 2007–2008.

- Subra Suresh began his tenure as dean of engineering on July 1, 2007.
- Eileen Ng-Ghavidel was named the School's assistant dean for finance and personnel in July 2007.
- Cynthia Barnhart, who holds appointments in the Department of Environmental Engineering and in the Engineering Systems Division, was named the School's associate dean for academic affairs in September 2007, replacing Dick Yue, who was named to a new position as director of international programs for the School.

- Dedric Carter, former executive director of the Office of Engineering Outreach Programs for the School, was named assistant dean for development and strategic initiatives in January 2008.
- Karen Gleason, the Alexander and I. Michael Kasser professor of chemical engineering, was named the School's first associate dean for research in April 2008.
- Chad Galts was named the School's director of communications in May 2008.
- Shawna Young was named executive director of the Office of Engineering Outreach Programs in June 2008.

Faculty Honors and Awards

Each year, faculty members in the School of Engineering receive numerous honors in recognition of their research and service, many offered by professional societies and the faculty's professional communities. This year was no exception. The reports of the School's departments, laboratories, centers, and programs make note of many of these awards; a small, anecdotal sampling of this year's honors and awards is reported below

Robert Armstrong, Chemical Engineering, was elected to the National Academy of Engineering.

Arvind, Electrical Engineering and Computer Science, Computer Science and Artificial Intelligence Laboratory, was elected to the National Academy of Engineering.

Sangeeta Bhatia, Electrical Engineering and Computer Science, was named a Howard Hughes Medical Institute investigator.

Jacopo Buongiorno, Nuclear Science and Engineering, received the Junior Bose Junior Faculty Award for Excellence in Teaching.

W. Craig Carter, Materials Science and Engineering, received the School of Engineering's Bose Award for Excellence in Teaching.

Arup K. Chakraborty, Chemical Engineering, received the Distinguished Alumnus Award from the Indian Institute of Technology-Kanpur and served as chair of the Strategic Planning Council for the School of Engineering.

Joseph F. Coughlin, Engineering Systems Division, was named one of "12 People Who Are Changing Your Retirement" by the *Wall Street Journal*.

Joel Dawson, Electrical Engineering and Computer Science, received a National Science Foundation CAREER Award and a Deshpande Center innovation grant.

Edward DeLong, Civil and Environmental Engineering, was elected to the National Academy of Sciences.

Erik Demaine, Electrical Engineering and Computer Science, has his artwork cofeatured at the Museum of Modern Art in New York City.

Olivier L. deWeck, Aeronautics and Astronautics and Engineering Systems Division, was coauthor of the 2007 Best Paper of the Year in Systems Engineering.

Linda Griffith, Mechanical Engineering, received a MacArthur “Genius” Fellowship.

Darrell J. Irvine, Materials Science and Engineering, was named a Howard Hughes Medical Institute investigator.

Klavs F. Jensen, Chemical Engineering, was elected to the American Association for the Advancement of Science.

James L. Kirtley Jr., Electrical Engineering and Computer Science, was elected to the National Academy of Engineering.

Robert Langer, Institute Professor, Chemical Engineering, was elected to the Biotechnology Hall of Fame and received the National Medal of Science, the Millennium Technology Prize, the Herman Mark Award, a Chemistry of Materials Award from the American Chemical Society, the Max Planck Research Award, an Acta Biomaterialia Gold Medal, and the 2008 Prince of Asturias Award for Technical and Scientific Research from the Fundación Príncipe de Asturias.

Tom Leighton, Computer Science and Artificial Intelligence Laboratory, was elected to the National Academy of Sciences.

Nancy Leveson, Aeronautics and Astronautics and Engineering Systems Division, was named one of the Federal 100—the top executives from government, industry, and academia who had the greatest impact on the government information systems community in 2007.

Chiang Mei, Mechanical Engineering, received the Theodore Von Karman Medal from the American Society of Civil Engineers.

Silvio Micali, Electrical Engineering and Computer Science, was elected to of the National Academy of Sciences.

Dava Newman, Aeronautics and Astronautics and Engineering Systems Division, was named one of the Best Inventors of 2007 by *Time* magazine for her BioSuit™ system, featured in the Metropolitan Museum of Art’s Super Heroes exhibit.

Yossi Sheffi, *Engineering Systems Division*, testified before the full House Committee on Homeland Security in a session on “Broadening the Homeland Security Strategy.”

Henry Smith, Electrical Engineering and Computer Science, was elected to the American Academy of Arts & Sciences.

Francesco Stellacci, Materials Science and Engineering, was one of the winners of *Nanotech Briefs'* third annual Nano 50™ Awards.

Subra Suresh, Materials Science and Engineering and Mechanical Engineering, was named a fellow of the Materials Research Society, won the 2008 A.C. Eringen Medal, and was named an honorary member of the Spanish Royal Academy of Sciences.

Ian A. Waitz, Aeronautics and Astronautics, received the 2007 Excellence in Aviation Research Award from the Federal Aviation Administration.

Mehmet Fatih Yanik, Electrical Engineering and Computer Science, was named one of *Technology Review's* 35 top innovators worldwide under the age of 35.

Statistics for 2007–2008

Undergraduate Enrollment

- 1,851 students
- 40 percent women
- 23 percent underrepresented minorities

Graduate Enrollment

- 2,807 students
- 711 women
- 145 underrepresented minorities

Degrees Awarded, 2008

- 634 bachelor's degrees
- 748 master's degrees
- 315 doctoral and professional degrees

Faculty

- 255 professors
- 73 associate professors
- 40 assistant professors

Subra Suresh

Dean

Ford Professor of Engineering

More information about the School of Engineering can be found at <http://engineering.mit.edu/>.